(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 290 814 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.03.2018 Bulletin 2018/10

(51) Int Cl.:
F24F 1/06 *(2011.01)* ***F28G 9/00*** *(2006.01)*
F25B 39/02 *(2006.01)*

(21) Application number: **17189016.3**

(22) Date of filing: **01.09.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **01.09.2016 US 201615254933**

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(54) **SYSTEM AND METHOD FOR AIR CONDITIONER EVAPORATOR COIL CLEANING**

(57) The present invention is directed to systems and methods for cleaning a component inside a machine, such as an evaporator coil inside an air conditioner. A pump is connected to a controlling device. The pump is also connected to a metering device. The metering device is connected to one or more reservoirs. The metering device is also connected to one or more wands. Each wand is positioned inside a housing containing the component to spray cleaning solution, drawn from the reservoirs by the metering device, onto a face of the component. To perform the cleaning of the component, the controlling device disables the machine. The controlling device then activates the pump. The pump causes cleaning solution to be drawn from the one or more reservoirs into the metering device, which then transfers the cleaning solution into the wands. The controlling device then allows the machine to resume operation.

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Description

FIELD OF THE INVENTION

[0001] The present disclosure is generally directed to an improvement in the operation of an air conditioner, and is more particularly directed to methods and systems of cleaning an evaporator coil in an air conditioner while the air conditioner is in service.

BACKGROUND

[0002] It is common for air conditioners to cool air through the use of an evaporator coil housed inside the plenum of the air conditioner. Evaporators coils draw moisture from the air being cooled, in the form of condensation. Because the evaporator coils are located inside the plenum, they are not exposed to light. The wet, dark environment inside the plenum is an ideal environment for the growth of mildew. Accordingly, it is common for mildew to grow on the surfaces of the evaporator coil. Because air is flowing over the evaporator coil while the air conditioner is operating, air is also flowing over the accumulated mildew. Sufficient mildew buildup can cause the air conditioner to operate at reduced efficiency, because less air is able to flow over the coil in a given amount of time. In some cases, the mildew buildup is sufficient to cause a strain on the air conditioner motor, causing other repairs to be necessary. In extreme cases, mildew also grows in the path for condensation to leave the building, causing a backup of condensation to occur, which can lead to leaks and flooding inside the building. Sufficient levels of mildew can also make the air unhealthy to breathe, because microscopic amounts of mildew are blown away from the evaporator coil by the airflow, allowing the mildew to flow freely in the circulated air.

[0003] Existing systems for cleaning the coil involve removing a panel from the plenum and spraying a cleanser on the evaporator coil or completely removing the evaporator coil for a more thorough cleaning. These systems are time consuming and require human interaction. Accordingly, evaporator coils are not cleaned often. In some cases, the evaporator coils may not be cleaned, if at all, until there is a problem with air quality or a problem with the operation of the air conditioner.

BRIEF OVERVIEW

[0004] To address the problems stated above, it is desirable to have a cleaning system that cleans the evaporator coil before a build-up of mildew occurs. Such a system would allow air conditioners to operate more efficiently, because the flow of air would not be impeded by mildew on the evaporator coil. Such a system would also allow for a lower cost of repairs because the air conditioner would not break down due to the buildup of mildew. Such a system would also prevent costly repairs due to leaks or flooding caused by a mildew buildup inside the drainage system for air conditioner condensation, which could lead to fewer insurance claims being filed. Such a system would also lead to healthier air quality inside the building, because the air would not be contaminated by mildew buildup inside the air conditioner. Such a system could also be used to clean components in other types of machines.

[0005] This brief overview is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This brief overview is not intended to identify key features or essential features of the claimed subject matter. Nor is this brief overview intended to be used to limit the claimed subject matter's scope.

[0006] The present disclosure is directed to systems and methods for cleaning a component of a machine while the machine is in service, such as an evaporator coil inside an air conditioner while the air conditioner is in service. The systems described can be retrofitted in an air conditioner that is already installed in a building. The systems described can also be incorporated into an air conditioner before it is installed in a building.

[0007] Wands may be located inside the plenum of the air conditioner with nozzles directed at the face of the evaporator coil. The ingredients for the cleaning solution may be drawn from one or more reservoirs, to the wands, by a metering device that is connected to a pump. The pump may be controlled by a controlling device. The controlling device may also be able to turn the air conditioner off for the duration of the cleaning cycle. The system may operate on a cycle, as often as is warranted by the size of the evaporator coil and the volume of air being handled by the air conditioner. The reservoirs can be refilled or replaced as needed.

[0008] The system may operate by disabling the air conditioner for a period of time. The system may then mechanically or electronically squirt a cleaning solution on the face of the evaporator coil inside the air conditioner using the described system. The system may then wait a period of time for the cleaning solution to work. The system may then re-enable the air conditioner so it can resume normal operations.

[0009] Both the foregoing brief overview and the following detailed description provide examples and are explanatory only. Accordingly, the foregoing brief overview and the following detailed description should not be considered to be restrictive. Further, features or variations may be provided in addition to those set forth herein. For example, embodiments may be directed to various feature combinations and sub-combinations described in the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The accompanying drawings, which are incorporated in and constitute a part of this disclosure, illustrate various embodiments of the present disclosure. In

addition, the drawings may contain other marks owned by third parties and are being used for illustrative purposes only. All rights to various trademarks and copyrights represented herein, except those belonging to their respective owners, are vested in and the property of the Applicant. The Applicant retains and reserves all rights in its trademarks and copyrights included herein, and grants permission to reproduce the material only in connection with reproduction of the granted patent and for no other purpose.

[0011] Furthermore, the drawings may contain text or captions that may explain certain embodiments of the present disclosure. This text is included for illustrative, non-limiting, explanatory purposes of certain embodiments detailed in the present disclosure. In the drawings:

FIG. 1 is one embodiment of an air handling unit in a typical air conditioning system.

FIG. 2 is one embodiment of the face of a typical evaporator coil used in an air conditioning system.

FIG. 3 is one embodiment of a system consistent with embodiments of the present disclosure.

FIG. 4 illustrates a side view of an embodiment of the evaporator coil and the wand.

FIG. 5 illustrates a flow chart for performing a method for operating an embodiment of an evaporator coil cleaning system in accordance to an embodiment of the present disclosure.

FIG. 6 illustrates a flow chart for performing a method for operating an embodiment of an evaporator coil cleaning system in accordance to another embodiment of the present disclosure.

DETAILED DESCRIPTION

[0012] The evaporator coil cleaning system is integrated into a machine, such as an air conditioning system, so that it can run on a schedule without human intervention. At certain intervals, the cleaning system powers down the machine, squirts cleaning solution onto the component(s) to be cleaned, waits a period of time for the cleaning solution to work, and then powers up the machine, allowing normal operations to resume.

[0013] As a preliminary matter, it will readily be understood by one having ordinary skill in the relevant art that the present disclosure has broad utility and application. As should be understood, any embodiment may incorporate only one or a plurality of the above-disclosed aspects of the disclosure and may further incorporate only one or a plurality of the above-disclosed features. Furthermore, any embodiment discussed and identified as being "preferred" is considered to be part of a best mode contemplated for carrying out the embodiments of the present disclosure. Other embodiments also may be discussed for additional illustrative purposes in providing a full and enabling disclosure. Moreover, many embodiments, such as adaptations, variations, modifications, and equivalent arrangements, will be implicitly disclosed by the embodiments described herein and fall within the scope of the present disclosure.

[0014] Accordingly, while embodiments are described herein in detail in relation to one or more embodiments, it is to be understood that this disclosure is illustrative and exemplary of the present disclosure, and are made merely for the purposes of providing a full and enabling disclosure. The detailed disclosure herein of one or more embodiments is not intended, nor is to be construed, to limit the scope of patent protection afforded in any claim of a patent issuing here from, which scope is to be defined by the claims and the equivalents thereof. It is not intended that the scope of patent protection be defined by reading into any claim a limitation found herein that does not explicitly appear in the claim itself.

[0015] Thus, for example, any sequence(s) and/or temporal order of steps of various processes or methods that are described herein are illustrative and not restrictive. Accordingly, it should be understood that, although steps of various processes or methods may be shown and described as being in a sequence or temporal order, the steps of any such processes or methods are not limited to being carried out in any particular sequence or order, absent an indication otherwise. Indeed, the steps in such processes or methods generally may be carried out in various different sequences and orders while still falling within the scope of the present invention. Accordingly, it is intended that the scope of patent protection is to be defined by the issued claim(s) rather than the description set forth herein.

[0016] Additionally, it is important to note that each term used herein refers to that which an ordinary artisan would understand such term to mean based on the contextual use of such term herein. To the extent that the meaning of a term used herein-as understood by the ordinary artisan based on the contextual use of such term-differs in any way from any particular dictionary definition of such term, it is intended that the meaning of the term as understood by the ordinary artisan should prevail.

[0017] Regarding applicability of 35 U.S.C. §112, ¶6, no claim element is intended to be read in accordance with this statutory provision unless the explicit phrase "means for" or "step for" is actually used in such claim element, whereupon this statutory provision is intended to apply in the interpretation of such claim element.

[0018] Furthermore, it is important to note that, as used herein, "a" and "an" each generally denotes "at least one," but does not exclude a plurality unless the contextual use dictates otherwise. When used herein to join a list of items, "or" denotes "at least one of the items," but does not exclude a plurality of items of the list. Finally, when used herein to join a list of items, "and" denotes "all of the items of the list."

[0019] The following detailed description refers to the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the following description to refer to the same or similar elements. While many embodiments of the disclosure may

be described, modifications, adaptations, and other implementations are possible. For example, substitutions, additions, or modifications may be made to the elements illustrated in the drawings, and the methods described herein may be modified by substituting, reordering, or adding stages to the disclosed methods. Accordingly, the following detailed description does not limit the disclosure. Instead, the proper scope of the disclosure is defined by the appended claims. The present disclosure contains headers. It should be understood that these headers are used as references and are not to be construed as limiting upon the subjected matter disclosed under the header.

[0020] The present disclosure includes many aspects and features. Moreover, while many aspects and features relate to, and are described in, the context of cleaning the evaporator coil of an air conditioner while it is in service, embodiments of the present disclosure are not limited to use only in this context and can be used to clean any waterproof component of any machine. The cleaning wand is located inside the housing of the machine that the component is located in.

[0021] Embodiments of the present disclosure can be retrofitted onto, but not limited to, for example, an air handling unit **100** of a conventional air conditioner system. **FIG. 1** is just one embodiment of an air handling unit in a typical air conditioning system compatible with the systems and methods described herein. Further still, embodiments of the present disclosure can be manufactured and sold as an integrated air conditioning system. Air conditioning system **100** can be any type of air conditioner system that cools air with the use of an evaporator coil. Air conditioning system **100** can be installed in a residential or commercial building.

[0022] **FIG. 1** depicts air flow with arrows **120.** For example, air enters a plenum **102** through the return **104** and exits plenum **102** through a supply 106. The plenum houses the evaporator coil **108.** Evaporator coil **108** is an A-frame coil. The examples described herein may also work with slant coils, H coils, or other types of coils. Condensation accumulating on the coil during the cooling process may drain into channels **110,** which may then direct the accumulated condensate to a safe place, usually outside the building, through a system of pipes (not shown). In some embodiments, a drain pan (not shown) may be used to direct the condensate outside the building.

[0023] **FIG. 2** is just one embodiment of the face **200a** and **200b** of a typical evaporator coil used in an air conditioning system, before and after it is clogged with mildew. In various embodiments, fins **202** may be arranged in rows roughly parallel to each other. The coolant enters the evaporator coil through a pipe or tube at an entrance **204,** with the pipe or hose shaped to direct the coolant throughout the evaporator coil. The coolant may exit the evaporator coil at an exit **206.** Over time, mildew may accumulate on and between fins **202** of the evaporator coil. In this depiction, the space between the fins of evaporator coil face **200a** is clean and the space between the fins of evaporator coil face **200b** is clogged with mildew, as demonstrated by the shading in **200b.**

[0024] **FIG. 3** is just one embodiment of a system **300** consistent with embodiments of the present disclosure. Plenum **302** houses the evaporator coil and part of the cleaning system. Consistent with embodiments of the present disclosure, air may enter the plenum **302** at the return **304,** runs across the evaporator coil **308,** and may exit at the supply **306.** Wands **310** may be placed inside the plenum roughly parallel to each face of the evaporator coil. The wands **310** may be of a length and diameter suitable to be able to spray cleaning solution along the entire face of the coil.

[0025] The wands **310** may be connected to the metering device **312** using tubing or pipe. The metering device **312** may be mechanically or electronically controlled to cause an appropriate amount of the various components of the cleaning solution to enter the wands **310** and be sprayed on the coil. The components of the cleaning solution may be taken from reservoir A **314,** reservoir B **316,** and a water system **318.** In some embodiments, the components of the cleaning solution may be stored in different reservoirs because the cleaning solution will break down if the components are mixed before the cleaning solution will be used. However, nonreactive components may be premixed, reducing the number of reservoirs needed and other components may be added to the cleaning solution, increasing the number of reservoirs needed. The reservoirs may be attached to the exterior of the plenum **302** or hung at an appropriate height nearby. An appropriate height could be any height that allows the pump **320** to cause the reservoir contents to enter the metering device **312.** The reservoirs containing the components of the cleaning solution may be refillable or replaceable. In a typical residential installation, replacement reservoirs may be attached to the tubing or piping leading to the metering device after the empty reservoir is removed. Any currently existing system of removing and attaching the reservoirs may be used. Refillable reservoirs may also be removable, for the purpose of refilling.

[0026] The water system **318** may be any system that supplies water to the metering device **312.** For example, the water system **318** may be a reverse osmosis filtration system that is connected to the building plumbing. In some embodiments, the water system **318** may draw water from the building plumbing, run it through the reverse osmosis filtration, and supply the filtered water to the metering device **312.** It is also foreseeable that in cases where the water supply cannot be connected to plumbing, the water system **318** may be a tank of purified water.

[0027] Because the cleaning solution is being used in a system that supplies air to the building, fumes from the cleaning solution may be inhaled by occupants of the building. It is therefore desirable for the cleaning solution to be non-toxic and organic. However, the system is operable with any type of solution that will kill and break

down mildew. In some embodiments, one reservoir stores hydrogen peroxide and a second reservoir stores a blend of organic cleansing agents. The blend of organic cleansing agents may be a mixture of grapefruit seed extract and orange oil. The hydrogen peroxide acts as a fizzing agent, the grapefruit seed extract acts as the working ingredient that operates to kill any mildew that has started to grow and break it down so that it will be rinsed away during the cleaning process, the orange oil acts as a surfactant, and the water acts as the carrier. Other combinations of ingredients may be used, with the appropriate number of reservoirs incorporated into the system.

[0028] Returning to **FIG. 3,** the metering device **312** may be connected to pump **320** using tubing or pipe so that pump **320** can cause the metering device **312** to draw fluid from the reservoirs. Pump **320** may be connected to a controlling device **322.** The controlling device **322** may be programmed with the time and duration for the cleaning system to run. The controlling device **322** may be configurable **via a user interface.** The controlling device **322** may also be connected to the air conditioner controls **324,** which may in turn be connected to the air conditioner motor **326.** The controlling device **322** may ensure that the cleaning system and the air conditioner will not operate at the same time by turning off the air conditioner when the cleaning system is about to run. Turning off the air conditioner may prevent the cleaning solution from being blown about inside the plenum **302** and instead allows for the cleaning solution to reach the evaporator coil **308.** The controlling device **322** also may prevent the air conditioner from powering on until an amount of time has passed for the cleaning solution to kill and break down the mildew. After the amount of time has passed, the controlling device **322** may stop preventing the air conditioner from powering on, so that the air conditioner may once again be operated by the air conditioner controls **324.**

[0029] The frequency of the operation of the cleaning system, the length of time the cleaning system runs, and the amount of time allowed for the cleaning solution to work before the air conditioner continues normal operations may vary according to the size of the coil being cleaned and the amount of air being handled by the air conditioner. Other factors may be considered. These time periods would typically be set at the factory, but may be configurable onsite, through the use of the controlling device **322.** In one example, the controlling device **322** may disable the air conditioner and operate the cleaning system once every seventy-two hours, the cleaning system may run for thirty seconds, and the controlling device **322** may keep the air conditioner from powering back on for five minutes.

[0030] **FIG. 4** is just one illustration of a side view of some embodiments of the evaporator coil and the wand. **FIG. 4** depicts just one face **410** of the evaporator coil and the wand **412** used to clean it, which are housed inside the plenum. Each wand **412** may comprise a rod **402** and multiple nozzles **404.** The wand **412** may be connected to metering device **406** using tubing or pipes through the wall of the plenum **408,** and metering device **406** may then in turn be connected to the rest of the system as described above for **FIG. 3.** When wand **412** is activated, each nozzle **404** may squirt cleaning solution onto a portion of evaporator coil **412,** such that the cleaning solution from the nozzle overlaps with the cleaning solution from the neighboring nozzles and such that the entire surface area of the face **410** of the evaporator coil is sprayed with cleaning solution. Excess cleaning solution may drain into the system used to collect the condensate from the evaporator coil and direct it to an appropriate place.

[0031] When the cleaning system is activated, metering device **406** may feed cleaning solution into wand **412.** Within the wand **412,** cleaning solution may travel along rod **402** and may exit rod **402** through each of multiple nozzles **404.** After exiting through each of multiple nozzles **404,** cleaning solution may travel through the air towards evaporator coil **412** and land on evaporator coil **412.**

[0032] **FIG. 5** is a flow chart setting forth the general stages involved in a method **500** consistent with some embodiments of the disclosure. Method **500** may be implemented using a computing device.

[0033] Although the stages illustrated by the flow charts are disclosed in a particular order, it should be understood that the order is disclosed for illustrative purposes only. Stages may be combined, separated, reordered, and various intermediary stages may exist. Accordingly, it should be understood that the various stages illustrated within the flow chart may be, in various embodiments, performed in arrangements that differ from the ones illustrated. Moreover, various stages may be added or removed from the flow charts without altering or deterring from the fundamental scope of the depicted methods and systems disclosed herein. Ways to implement the stages of method **500** will be described in greater detail below.

[0034] Method **500** may begin at starting block **502** and proceed to stage **506.** For example, in **502,** the controlling device may operate a pump to draw a metered amount of substance from a reservoir. From stage **502,** the controlling device may advance to stage **504.**

[0035] In **504,** the pump may transfer the metered amount of substance to the wand. The wand is positioned to spray the metered amount of substance onto the evaporator coil. From stage **504,** the controlling device may advance to stage **506.**

[0036] In **506,** the metered amount of substance is sprayed through the wand onto the evaporator coil. Once the controlling device has completed stage **506,** method **500** may end.

[0037] Method **600** may begin at starting block **602** and proceed to stage **610** where a controlling device may disable the air conditioner from operating while the cleaning system is operating. For example, in **602,** the controlling device may be a computing device that disables

the air conditioner. For example, the controlling device may override the air conditioner controls and prevent the air conditioner from cycling on. The controlling device may accomplish this in a number of ways, including cutting power to the air conditioner or entering a temperature value into a thermostat that is higher than an operational thermostat setting. Other ways of preventing the air conditioner from cycling on can be envisioned. The controlling device may also be a mechanical device, such as a timer or other device connected to the thermostat. The mechanical controlling device may have a user interface that, for example, allows a user to move slider or dial controls to set the time to perform a cleaning cycle, the length of time for the cleaning cycle to run, the length of time for the air conditioner to be disabled, or the thermostat value that is used to disable the air conditioner. From stage **602,** the controlling device may advance to stage **604.**

[0038] In **604,** the controlling device may cause the pump to draw a metered amount of substance from the reservoir. From stage **604,** the controlling device may advance to stage **606.**

[0039] In **606,** the pump may transfer the metered amount of substance to the wand. From stage **606,** the controlling device may advance to stage **608.**

[0040] **In 608,** the substance is sprayed through the wand onto the evaporator coil. From stage **608,** the controlling device may advance to stage **610.**

[0041] In **610,** the controlling device may re-enable the air conditioner, such that it can continue to operate via the air conditioner controls. For example, the controlling device may enable the air conditioner by reversing the action taken in **602.**

[0042] Once the controlling device has completed stage **610,** method **600** may end.

[0043] Although methods **500** and **600** have been described in some embodiments to be performed by a computing device (e.g., computing device **700** described with reference to **FIG. 7,** it should be understood that, in some embodiments, different operations may be performed by different networked elements in operative communication with the computing device. For example, a server and/or a local computing device may be employed in the performance of some or all of the stages in methods **500** and **600.** Moreover, the server may be configured much like the computing device and, in some instances, be one and the same embodiment. Similarly, a local controlling device may be employed in the performance of some or all of the stages in methods **500** and **600.** A controlling device may also be configured much like a computing device.

[0044] Aspects of the present disclosure may be implemented using any material suitable for the amount of pressure exerted on the system and in various configurations with the parts connected in any manner. The system may be controlled electronically, wirelessly, or using a combination of electronic and wireless communications using any suitable communication protocol. The system may be part of a network of appliances installed according to the Internet of Things. The system may include an input device configured to accept input corresponding to the frequency and duration of the operation of the system. The system may include an input device configured to output supply levels or present the results of the system operations to the user. A computing device may be used in the implementation of the various embodiments described here.

[0045] **FIG. 7** is a block diagram of a system including computing device **700.** Consistent with an embodiment of the disclosure, a memory storage and processing unit may be implemented in a computing device, such as computing device **700** of **FIG. 7.** Any suitable combination of hardware, software, or firmware may be used to implement the memory storage and processing unit. For example, the memory storage and processing unit may be implemented with computing device **700** or any of other computing devices **718,** in combination with computing device **700.** The aforementioned system, device, and processors are examples and other systems, devices, and processors may comprise the aforementioned memory storage and processing unit, consistent with embodiments of the disclosure.

[0046] With reference to **FIG. 7,** a system consistent with an embodiment of the disclosure may include a computing device, such as computing device **700.** In a basic configuration, computing device **700** may include at least one processing unit **702** and a system memory **704.** Depending on the configuration and type of computing device, system memory **704** may comprise, but is not limited to, volatile (e.g. random access memory (RAM)), nonvolatile (e.g. read-only memory (ROM)), flash memory, or any combination. System memory **704** may include operating system **705,** one or more programming modules **706,** and may include program data **707.** Operating system **705,** for example, may be suitable for controlling the operation of computing device **700.** In one embodiment, programming modules **706** may include a timing module that controls the frequency and the duration of the cleaning cycle, a pump operation module that controls the amount of fluid drawn from each reservoir, and a machine control module that disables the machine containing the component during the cleaning cycle. Furthermore, embodiments of the disclosure may be practiced in conjunction with a graphics library, other operating systems, or any other application program and is not limited to any particular application or system. This basic configuration is illustrated in **FIG. 7** by those components within a dashed line **708.**

[0047] Computing device **700** may have additional features or functionality. For example, computing device **700** may also include additional data storage devices (removable and/or non-removable) such as, for example, magnetic disks, optical disks, or tape. Such additional storage is illustrated in **FIG. 7** by a removable storage **709** and a non-removable storage **710.** Computer storage media may include volatile and nonvolatile, removable and non-

removable media implemented in any method or technology for storage of information, such as computer readable instructions, data structures, program modules, or other data. System memory **704,** removable storage **709,** and non-removable storage **710** are all computer storage media examples (i.e., memory storage.) Computer storage media may include, but is not limited to, RAM, ROM, electrically erasable read-only memory (EEPROM), flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store information and which can be accessed by computing device **700.** Any such computer storage media may be part of device **700.** Computing device **700** may also have input device(s) **712** such as a keyboard, a mouse, a pen, a sound input device, a touch input device, etc. Output device(s) **714** such as a display, speakers, a printer, etc. may also be included. The aforementioned devices are examples and others may be used.

[0048] Computing device **700** may also contain a communication connection **716** that may allow device **700** to communicate with other computing devices **718,** such as over a network in a distributed computing environment, for example, an intranet or the Internet. Communication connection **716** is one example of communication media. Communication media may typically be embodied by computer readable instructions, data structures, program modules, or other data in a modulated data signal, such as a carrier wave or other transport mechanism, and includes any information delivery media. The term "modulated data signal" may describe a signal that has one or more characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media may include wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, radio frequency (RF), infrared, and other wireless media. The term computer readable media as used herein may include both storage media and communication media.

[0049] As stated above, a number of program modules and data files may be stored in system memory **704,** including operating system **705.** While executing on processing unit **702,** programming modules **706 (e.g., XXX application *20)** may perform processes including, for example, one or more of drawing a metered amount of substance from a reservoir, transferring the substance to a wand, or spraying the substance onto an evaporator coil as described above. The aforementioned process is an example, and processing unit **702** may perform other processes. Other programming modules that may be used in accordance with embodiments of the present disclosure may include air conditioning controls, user interface applications, etc.

[0050] Generally, consistent with embodiments of the disclosure, program modules may include routines, programs, components, data structures, and other types of structures that may perform particular tasks or that may implement particular abstract data types. Moreover, embodiments of the disclosure may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, minicomputers, mainframe computers, and the like. Embodiments of the disclosure may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

[0051] Furthermore, embodiments of the disclosure may be practiced in an electrical circuit comprising discrete electronic elements, packaged or integrated electronic chips containing logic gates, a circuit utilizing a microprocessor, or on a single chip containing electronic elements or microprocessors. Embodiments of the disclosure may also be practiced using other technologies capable of performing logical operations such as, for example, AND, OR, and NOT, including but not limited to mechanical, optical, fluidic, and quantum technologies. In addition, embodiments of the disclosure may be practiced within a general purpose computer or in any other circuits or systems.

[0052] Embodiments of the disclosure, for example, may be implemented as a computer process (method), a computing system, or as an article of manufacture, such as a computer program product or computer readable media. The computer program product may be a computer storage media readable by a computer system and encoding a computer program of instructions for executing a computer process. The computer program product may also be a propagated signal on a carrier readable by a computing system and encoding a computer program of instructions for executing a computer process. Accordingly, the present disclosure may be embodied in hardware and/or in software (including firmware, resident software, micro-code, etc.). In other words, embodiments of the present disclosure may take the form of a computer program product on a computer-usable or computer-readable storage medium having computer-usable or computer-readable program code embodied in the medium for use by or in connection with an instruction execution system. A computer-usable or computer-readable medium may be any medium that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device.

[0053] The computer-usable or computer-readable medium may be, for example but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, device, or propagation medium. More specific computer-readable medium examples (a non-exhaustive list), the computer-readable medium may include the following: an electrical connection having one or more wires, a portable computer dis-

kette, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, and a portable compact disc read-only memory (CD-ROM). Note that the computer-usable or computer-readable medium could even be paper or another suitable medium upon which the program is printed, as the program can be electronically captured, via, for instance, optical scanning of the paper or other medium, then compiled, interpreted, or otherwise processed in a suitable manner, if necessary, and then stored in a computer memory.

[0054] Embodiments of the present disclosure, for example, are described above with reference to block diagrams and/or operational illustrations of methods, systems, and computer program products according to embodiments of the disclosure. The functions/acts noted in the blocks may occur out of the order as shown in any flowchart. For example, two blocks shown in succession may in fact be executed substantially concurrently or the blocks may sometimes be executed in the reverse order, depending upon the functionality/acts involved.

[0055] While certain embodiments of the disclosure have been described, other embodiments may exist. Furthermore, although embodiments of the present disclosure have been described as being associated with data stored in memory and other storage mediums, data can also be stored on or read from other types of computer-readable media, such as secondary storage devices, like hard disks, solid state storage (e.g., USB drive), or a CD-ROM, a carrier wave from the Internet, or other forms of RAM or ROM. Further, the disclosed methods' stages may be modified in any manner, including by reordering stages and/or inserting or deleting stages, without departing from the disclosure.

The present invention is directed to systems and methods for cleaning a component inside a machine, such as an evaporator coil inside an air conditioner. A pump is connected to a controlling device. The pump is also connected to a metering device. The metering device is connected to one or more reservoirs. The metering device is also connected to one or more wands. Each wand is positioned inside a housing containing the component to spray cleaning solution, drawn from the reservoirs by the metering device, onto a face of the component. To perform the cleaning of the component, the controlling device disables the machine. The controlling device then activates the pump. The pump causes cleaning solution to be drawn from the one or more reservoirs into the metering device, which then transfers the cleaning solution into the wands. The controlling device then allows the machine to resume operation.

Claims

1. A system for cleaning a component in a machine, comprising:

a pump;
a controlling device connected to the pump;
a metering device connected to the pump;
one or more reservoirs connected to the metering device; and
one or more wands connected to the metering device;
wherein the pump, the metering device, the reservoirs, and the wands are connected such that a fluid can flow from the reservoirs to the metering device, and from the metering device to the wands,
wherein the wands and a component to be cleaned are located inside a housing of a machine, and
wherein the wands are positioned such that a set of nozzles are directed to spray a cleaning solution towards the component to be cleaned.

2. The system of claim 1, wherein the controlling device is also connected to a controller, wherein the controller controls the machine.

3. The system of claim 1, further comprising:

a water filtration system, wherein the water filtration system is connected to a source of water and wherein the water filtration system is connected to the metering device.

4. The system of claim 3, wherein the source of water is a plumbing system inside a structure.

5. The system of claim 1, wherein the controlling device comprises a user interface.

6. The system of claim 1, wherein the reservoirs contain components of a cleaning solution.

7. The system of claim 7, wherein the components of the cleaning solution comprise hydrogen peroxide, grapefruit seed extract, and orange oil.

8. The system of claim 1, wherein the pump, the controlling device, the metering device, the one or more reservoirs, and the one or more wands, are connected using flexible tubing.

9. The system of claim 1, wherein the pump, the controlling device, the metering device, the one or more reservoirs, and the one or more wands, are connected using pipes.

10. A system for cleaning an evaporator coil, comprising:

a pump;
a controlling device connected to the pump;
a metering device connected to the controlling

device;
one or more reservoirs connected to the metering device;
one or more wands connected to the metering device; and
an evaporator coil configured to be integrated into an air conditioning system,
wherein the pump, the metering device, the reservoirs, and the wands are connected such that a fluid can flow from the reservoirs to the metering device, and from the metering device to the wands,
wherein the wands and the evaporator coil are located inside a plenum of the air conditioning system, and
wherein the wands are positioned such that a set of nozzles are directed to spray a cleaning solution towards the evaporator coil.

11. The system of claim 10, wherein the controlling device is also connected to a controller, wherein the controller controls the air conditioning system.

12. The system of claim 10, further comprising:

a water filtration system,
wherein the water filtration system is connected to a source of water, and
wherein the water filtration system is connected to the metering device.

13. The system of claim 12, wherein the source of water is a plumbing system inside a structure and wherein the air conditioning system is configured to cool air inside the structure.

14. The system of claim 10, wherein the reservoirs contain components of a cleaning solution.

15. The system of claim 15, wherein the components of the cleaning solution comprise hydrogen peroxide, grapefruit seed extract, and orange oil.

16. The system of claim 10, wherein the pump, the controlling device, the metering device, the one or more reservoirs, and the one or more wands, are connected using flexible tubing.

17. The system of claim 1, wherein the pump, the controlling device, the metering device, the one or more reservoirs, and the one or more wands, are connected using pipes.

18. A method comprising:

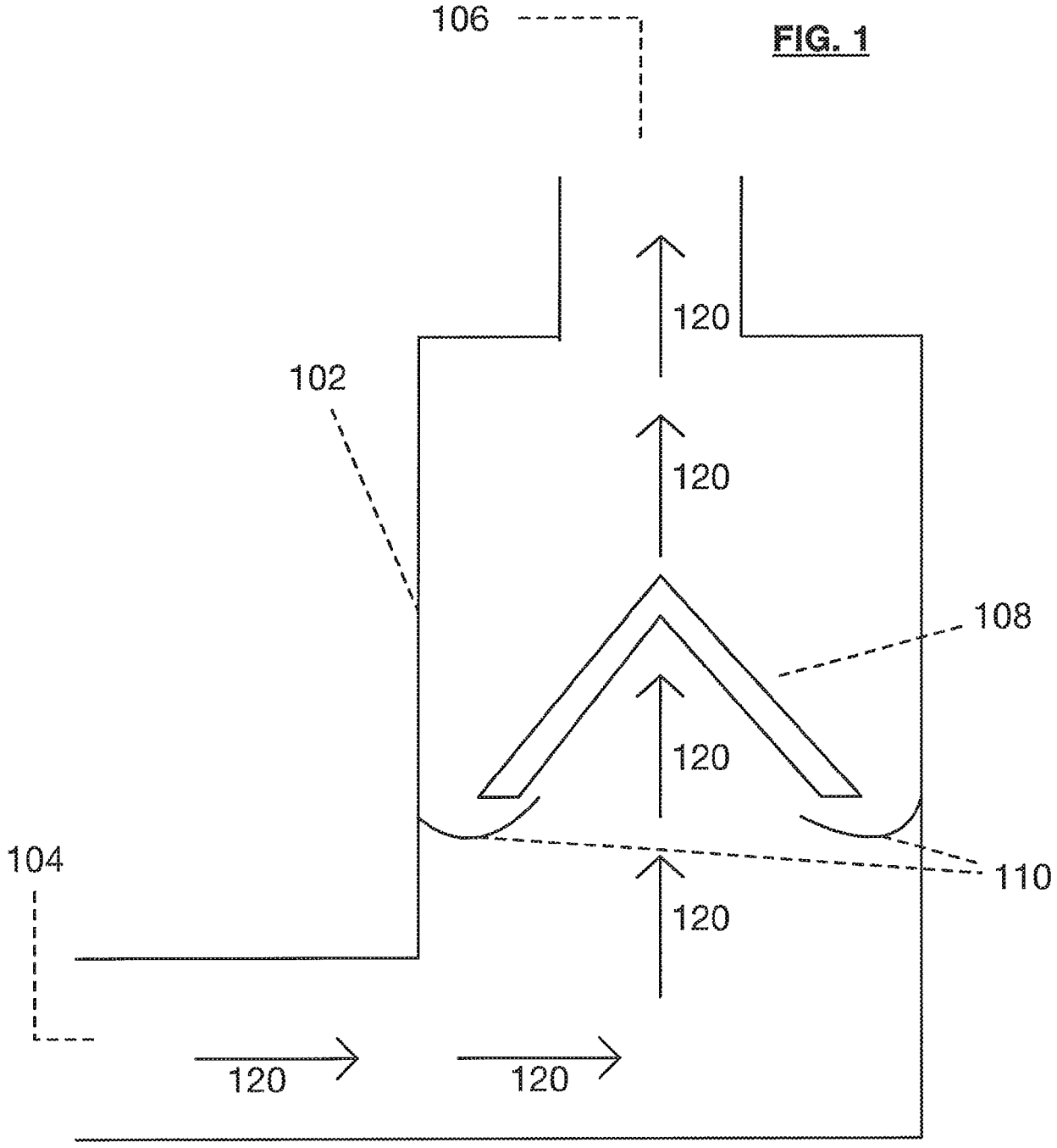
operating a pump, via a controlling device, to draw a metered amount of a substance from at least one reservoir;
transferring, via the pump, the substance to at least one wand, configured to spray the substance; and
spraying the substance, via the wands, onto an evaporator coil integrated within an air conditioner.

19. The method of claim 18, further comprising:

preventing, via a controller, an operation of an air conditioner; and
resuming, via the controller, the operation of the air conditioner.

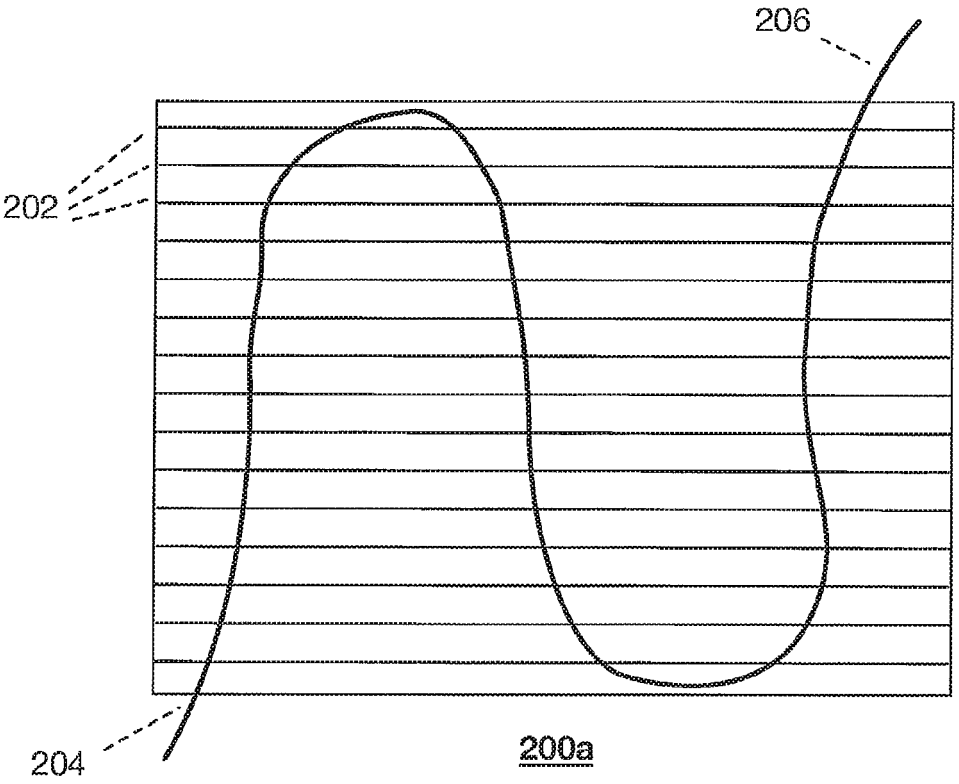
20. The method of claim 18, further comprising allowing a user, via a user interface, to enter a time for the controlling device to perform a cleaning cycle, a length of time for the cleaning cycle, or a length of time for the controlling device to prevent the air conditioner from operating.

FIG. 1

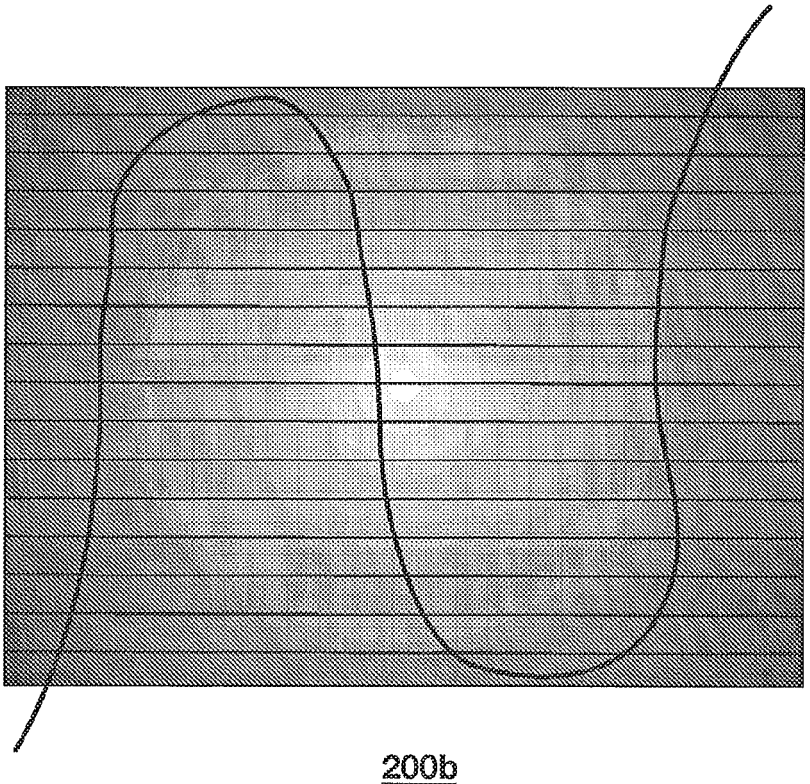


100

FIG. 2



200a



200b

FIG. 3

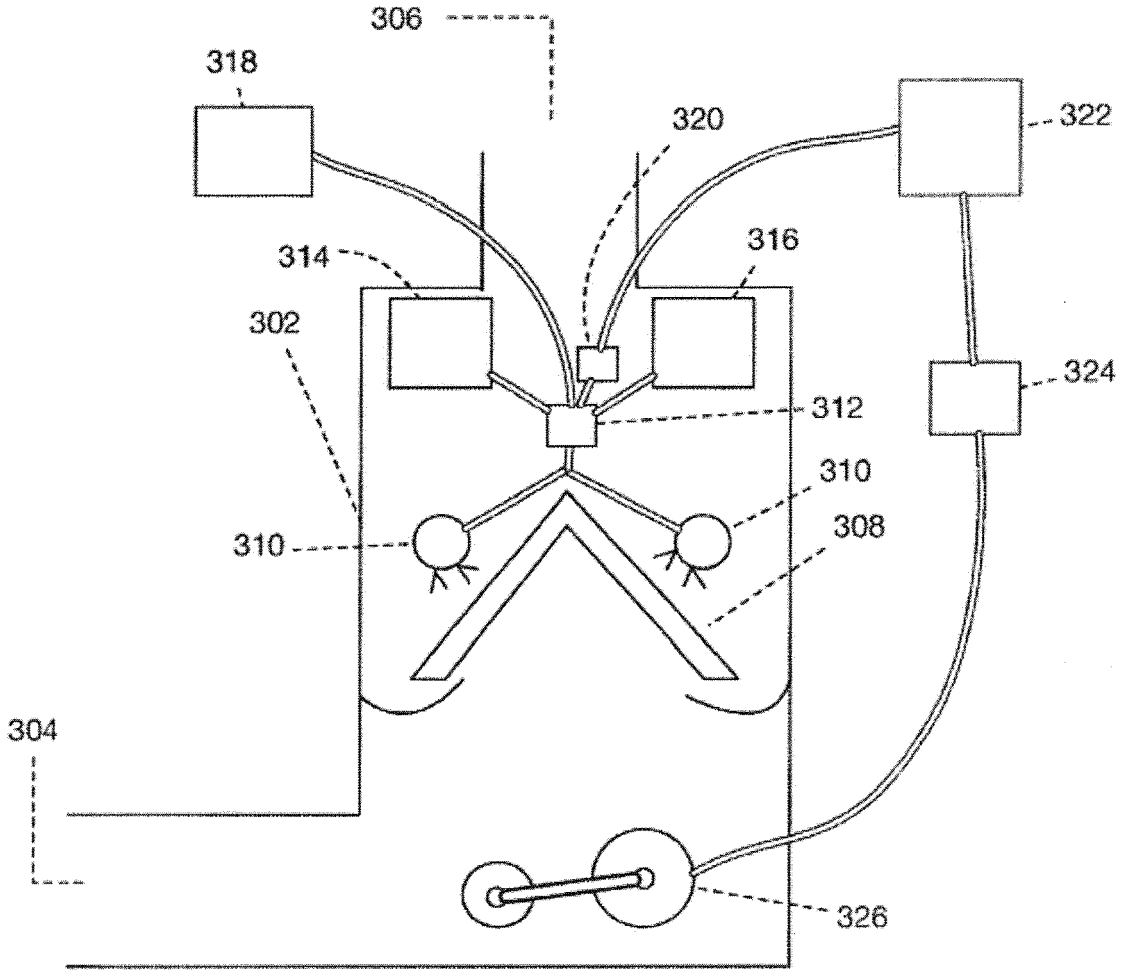


FIG. 4

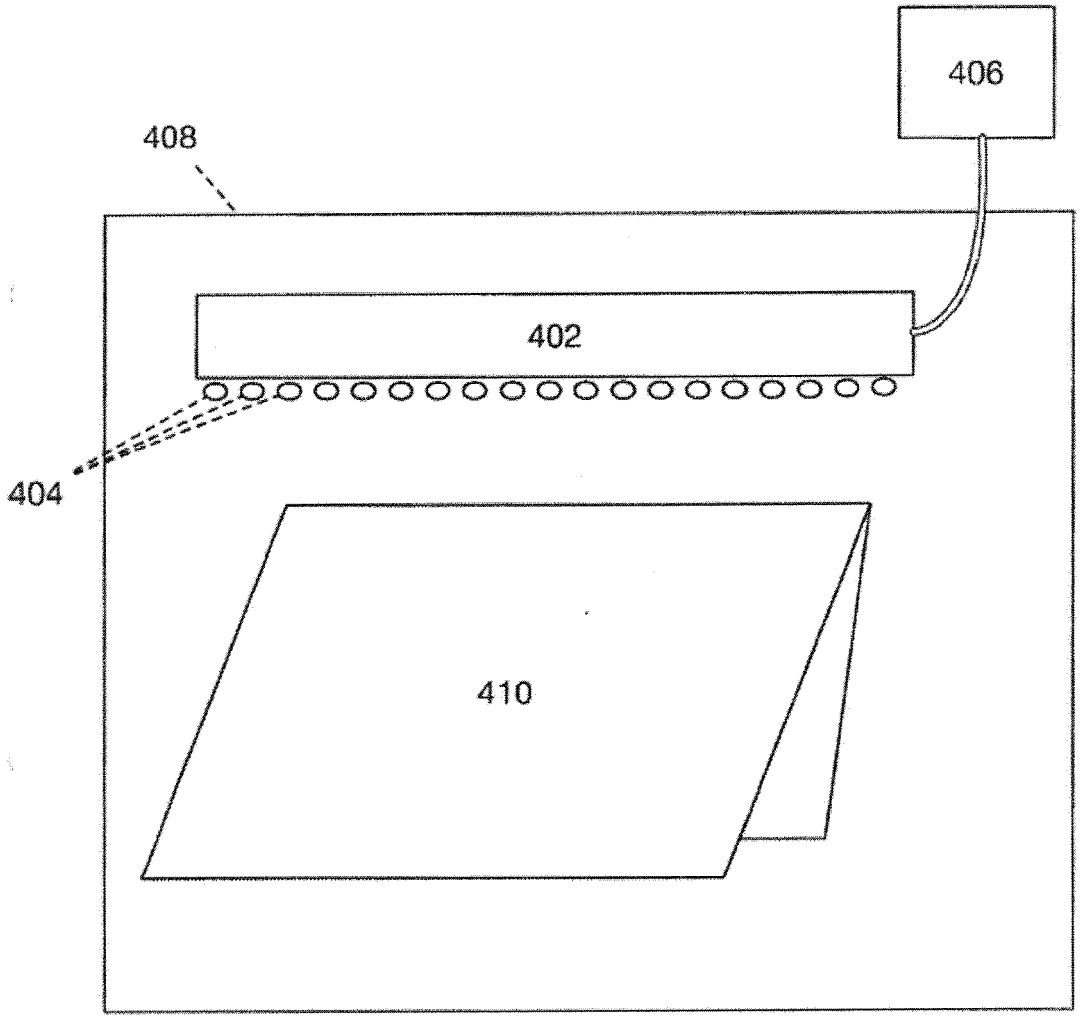


FIG. 5

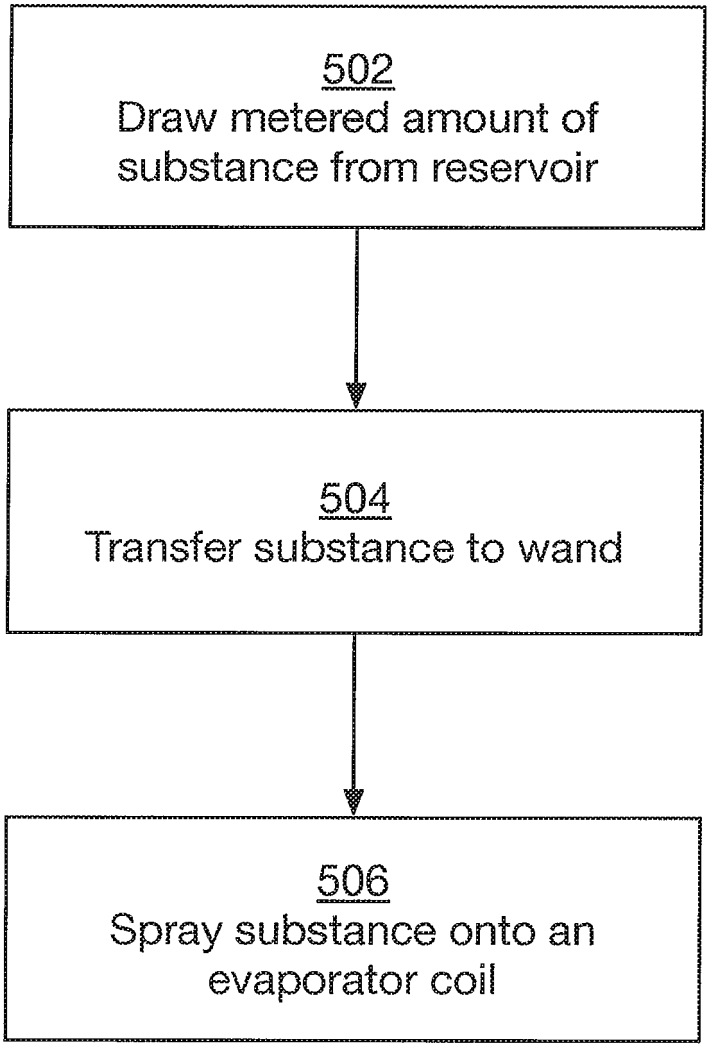
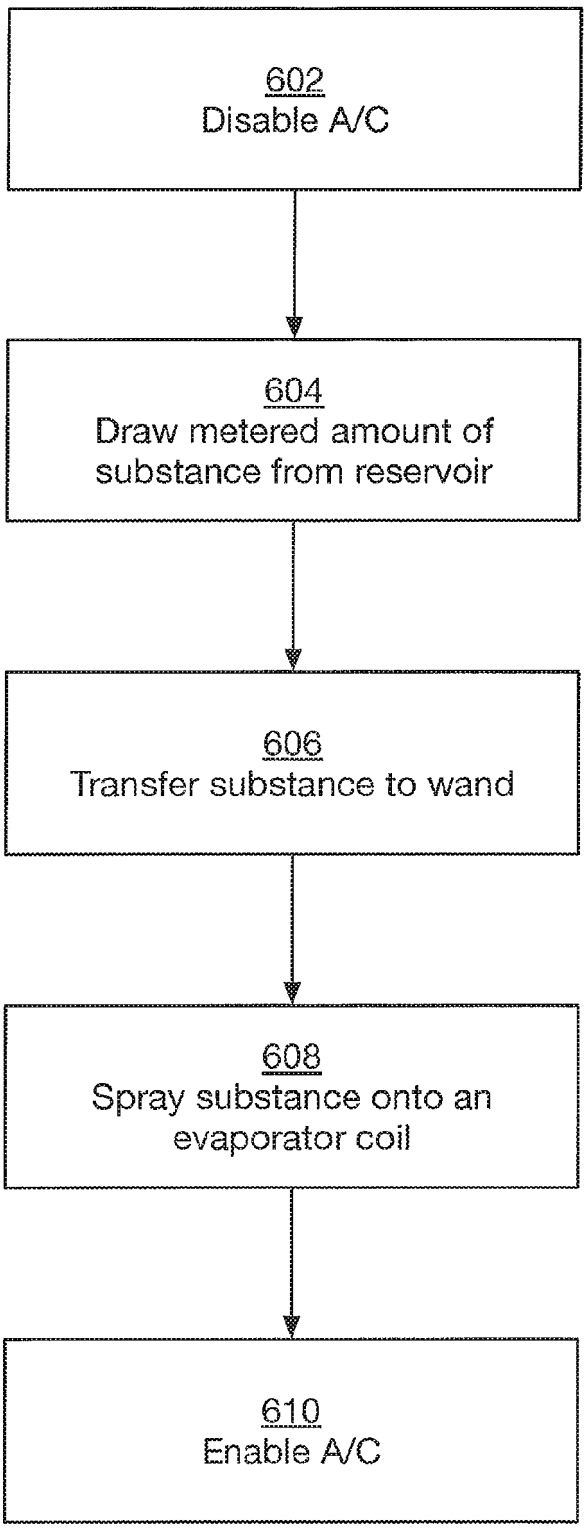

502
Draw metered amount of substance from reservoir
504
Transfer substance to wand
506
Spray substance onto an evaporator coil
500

FIG. 6


602
Disable A/C
604
Draw metered amount of substance from reservoir
606
Transfer substance to wand
608
Spray substance onto an evaporator coil
610
Enable A/C
600

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EUROPEAN SEARCH REPORT

Application Number
EP 17 18 9016

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	KR 101 150 501 B1 (GLOSEM [KR]) 31 May 2012 (2012-05-31) * the whole document *	1,3-19 2,20	INV. F24F1/06 F28G9/00 F25B39/02
Y	DE 103 44 653 A1 (GUENTNER GMBH HANS [DE]) 12 May 2005 (2005-05-12) * paragraphs [0003] - [0006]; figure 1 *	2	
Y	JP 2011 058646 A (TOA KANZAI KK) 24 March 2011 (2011-03-24) * pages 3-5; figure 1 *	20	
X	WO 94/17356 A1 (PAXTON G M AUSTRALIA PTY LTD [AU]; PAXTON GREGORY MARK [AU]; SPICE STE) 4 August 1994 (1994-08-04) * pages 3,8-10; figure 1 *	1,10,18	
X	US 9 266 152 B1 (KANE TIMOTHY [US] ET AL) 23 February 2016 (2016-02-23) * columns 5-7; figure 7 *	1,10,18	
X	WO 2005/075895 A1 (AEROSOLUTIONS LTD [NZ]; MCLISKY NIGEL HAIG [NZ]) 18 August 2005 (2005-08-18) * pages 5-8; figure 1 *	1,10,18	TECHNICAL FIELDS SEARCHED (IPC) F24F F28G F25B
X	JP 2005 351504 A (NAGAHAMA TOSHIKATSU) 22 December 2005 (2005-12-22) * paragraphs [0016] - [0030]; figure 1 *	1,10,18	
X	JP H08 327085 A (HITACHI PLANT ENG & CONSTR CO) 10 December 1996 (1996-12-10) * paragraphs [0010] - [0018]; figure 1 *	1,10,18	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 January 2018	Blot, Pierre-Edouard

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-01-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 101150501 B1	31-05-2012	NONE	
DE 10344653 A1	12-05-2005	NONE	
JP 2011058646 A	24-03-2011	JP 5519221 B2	11-06-2014
		JP 2011058646 A	24-03-2011
WO 9417356 A1	04-08-1994	NONE	
US 9266152 B1	23-02-2016	NONE	
WO 2005075895 A1	18-08-2005	NONE	
JP 2005351504 A	22-12-2005	NONE	
JP H08327085 A	10-12-1996	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82